

Institutional Opportunities: LMU Study

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### Institutional Opportunities: LMU Study

Demographics can often be valuable source of information for opportunities that exist at institutions. Descriptive statistics can be used to evaluate the status quo of a group, while inferential statistics explores relationships that may exist between variables. Although conclusions drawn based on inferential stats describe relationships that exist statistically, they do not indicate cause and effect. That said, however, it is helpful to analyze variables that are actionable to make positive change.

Depending on the nature of the variables selected, different statistical techniques need to be applied. The purpose of this paper is to uncover opportunities that exist for an institution by analyzing an existing database, generating various research questions based on all possible combinations of variables, selecting questions most applicable to the objective of the study, crunching the numbers to uncover relationships that exist, and finally, making recommendations based on those findings.

#### *Executive Summary*

In this scenario, the dean of engineering and computer science at LMU would like to enhance the department's reputation, thereby, attracting more applicants and grants. To this end, the dean has focused on evaluating the performance of current freshmen in the program to determine which demographic characteristics improve the likelihood of student success, as measured by GPA and units completed. She has commissioned a team of doctoral students to analyze data that is currently available and to make recommendations for future study.

### *Objective of the Study*

Since the dean seeks to improve the reputation of the college, two key variables to analyze would be LMU GPA and LMU units completed. However, after a preliminary look at LMU units completed yielded no relationships, the focus of this paper will be on LMU GPA.

The objective of the study is to improve student performance, so it is important to find a base level measurement of current performance. Using descriptive statistics, the current data shows that the average freshman GPA is 2.704 with a standard deviation of 0.537. The median is 2.68, and no mode. (Please refer to Appendix I – Descriptive Stats: LMU GPA.)

An exhaustive list of research questions were generated to explore possible areas of opportunity based on various statistical techniques. This paper summarizes one research question per technique. If relationships are found to exist, conclusions and recommendations are also outlined. (Please refer to Appendix II – Variables and Possible Research Questions.)

### **Research Questions, Assumptions, and Findings**

#### *Research Question Involving Chi-Square*

A Chi Square Analysis is performed to analyze the relationship between two attributes. All possible Chi-Square combinations were run, and in doing so, we found out that the only relationship that existed were between major (dependent variable) and gender (independent variable). According to the Chi-Square analysis, fewer female students in the mechanical engineering major were reported. There were 11 female students in the Mechanical Engineering major out of an expected 33. Fewer than expected male students were reported to have mechanical engineering as a major. Only 1 out of 19 expected male students had mechanical engineering as a major. Greater than expected male students were reported to have Electrical

Engineering as a major. 10 male students, out of an expected 4.4 reported to have electrical engineering as a major.

### *Research Question Involving One-Way ANOVA*

The ANOVA (Analysis of Variance) technique is applied to analyze the relationship between a numeric dependent variable and an attribute. When comparing the possible numeric variables to study, freshman GPA and units completed were the most aligned to the goals of the study. After running NCSS for all possible combinations for units completed, it was found that there was insufficient evidence for all relationships. When analyzing freshman GPA, three relationships were found: major, religion, and dorm residency. Of the three variables, the only actionable one is dorm residency, so it was analyzed more thoroughly. Is there a difference in average freshman GPA based on dorm residency?

After running NCSS, it was found that students who were dorm residents had higher average GPA (2.84) than non-residents (2.57). Based on this finding, the dean in this scenario would be justified in seeking more dorm facilities for freshmen. (Please refer to Appendix IV for analysis and NCSS report.)

### *Research Question Involving One Two-Way ANOVA with Interaction Analysis*

The two-way ANOVA with interaction analysis is applied to determine whether there is a relationship on a numeric variable based on an interaction of two attributes. The selection process used in the previous section for one-way ANOVA eliminated most of the attributes that had been measured. We focused on a possible interaction between dorm residency and major, which would take the previous analysis one step further. Independently, it was found that there was a relationship between LMU GPA and dorm residency and major. Students who were dorm

residents had higher GPAs as freshmen. ME's had lower GPAs than other majors. There was no interaction of the two variables. (Please refer to Appendix V for analysis and NCSS report.)

Although a cause and effect relationship does not exist, the finding suggests that LMU could raise freshmen GPA by encouraging freshmen to reside in dorms and providing ME majors academic support. Follow up studies and a larger sample size would serve to substantiate these recommendations.

#### *Research Question Involving ANCOVA*

Analysis of Covariance (ANCOVA) is conducted to compare averages of two or more groups that vary simultaneously when adjusted for a precondition. As such, the dependent variable is measured as a numeric (average of measurement) and the independent variable is an attribute (groups).

When comparing the possible variables to study, LMU GPA (as the dependent variable) and Gender (as the independent variable), adjusted for HS GPA, were the most aligned to the goals of the study. After running NCSS for all possible combinations for LMU GPA, it was found that there was a difference in LMU\_GPA based on Gender when adjusted for HS GPA. (Please refer to Appendix VI for analysis and NCSS report.)

#### *Research Question Involving One Correlation Analysis*

The Correlation Analysis technique is applied to analyze the relationship between a numeric dependent variable and a numeric independent variable. When comparing the possible numeric variables to study, freshman GPA and units completed were the most aligned to the goals of the study. Is there a relationship between the number of units taken and the student's GPA?

After running NCSS, it was found that students' GPA scores did not follow any pattern based on the number of units they took. Based on this finding, the dean in this scenario would be advised not promote the acceptance of either more fulltime or part-time students, at least if the purpose is to increase student GPA scores, in that there is no statistical relationship between the number of units taken and student GPA scores. (Please refer to Appendix VII for analysis and NCSS report.)

### Conclusions

Several conclusions were found after running Chi Square , ANCOVA, one and two ways ANOVA and correlation analysis:

- Fewer female students in the mechanical engineering major were reported (11 female students in the Mechanical Engineering major out of an expected 33).
- Fewer than expected male students were reported to have mechanical engineering as a major. (Only 1 out of 19 expected male students had mechanical engineering as a major).
- Greater than expected male students were reported to have Electrical Engineering as a major.
- Students who were dorm residents had higher average GPA (2.84) than non-residents (2.57).
- There was a relationship between LMU GPA and dorm residency and major (independently). Students who were dorm residents had higher GPAs as freshmen. ME's had lower GPAs than other majors. There was no interaction of the two variables.

### Recommendations

Based on this finding, although a cause and effect relationship does not exist, LMU could raise freshmen GPA by encouraging freshmen to reside in dorms and providing ME majors academic support.

### Suggestions for further research

Follow up studies and a larger sample size would serve to substantiate these recommendations.

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## Appendix I – Descriptive Stats: LMU GPA

## Descriptive Statistics Report

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## Summary Section of LMU\_GPA

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
52	2.704038	0.5374167	7.452629E-02	1.76	3.84	2.08

## Counts Section of LMU\_GPA

	Sum of Adjusted Frequencies	Missing Values	Distinct Values	Sum	Total Sum Squares	Sum
Rows Squares	52	0	46	140.61	394.9445	
	14.72965					

## Means Section of LMU\_GPA

Parameter	Mean	Median	Geometric Mean	Harmonic Mean	Sum	Mode
Value	2.704038	2.68	2.652144	2.601147	140.61	
Std Error	7.452629E-02				3.875367	
95% LCL	2.554421	2.37	2.509083	2.464375	132.8299	
95% UCL	2.853656	2.9	2.803363	2.753994	148.3901	
T-Value	36.28302					
Prob Level	0					
Count	52		52	52		0

The geometric mean confidence interval assumes that the  $\ln(y)$  are normally distributed.The harmonic mean confidence interval assumes that the  $1/y$  are normally distributed.

## Variation Section of LMU\_GPA

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.2888167	0.5374167	0.5400574	7.452629E-02	0.8225	2.08
Std Error	4.341359E-02	5.712149E-02		7.921326E-03		
95% LCL	0.2028431	0.450381		6.245662E-02		
95% UCL	0.4441755	0.6664649		9.242205E-02		

## Skewness and Kurtosis Section of LMU\_GPA

Parameter	Coefficient Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	of
Dispersion						
Value	0.3028521	2.174925	0.311923	-0.7853786	0.198746	
	0.1695608					
Std Error	0.1986609	0.2566222			1.439689E-02	

## Trimmed Section of LMU\_GPA

Parameter	5% Trimmed	10% Trimmed	15% Trimmed	25% Trimmed	35% Trimmed	45%
Trim-Mean	2.693675	2.680529	2.669506	2.665769	2.672051	
	2.677692					



Trim-Std Dev	0.466379 0.1087727	0.4013085	0.3363014	0.2523834	0.1843936	
Count	47	42	36	26	16	5

**Descriptive Statistics Report**

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**Mean-Deviation Section of LMU\_GPA**

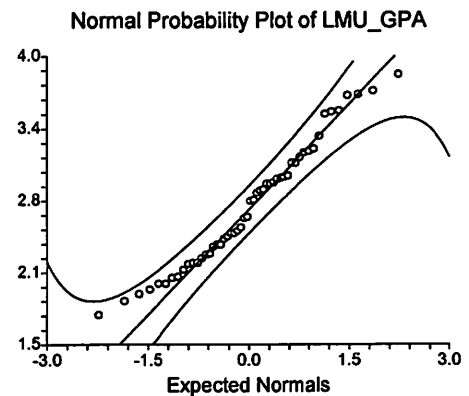
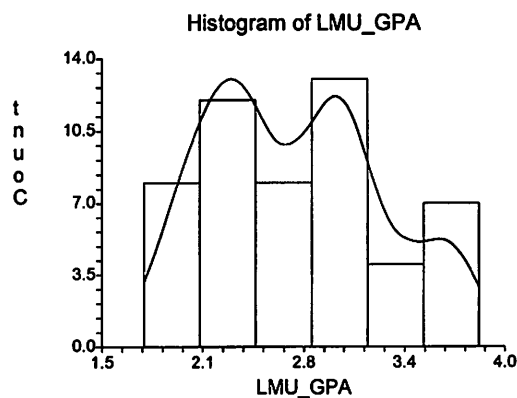
Parameter	X-Mean	X-Median	(X-Mean)^2	(X-Mean)^3	(X-Mean)^4
Average	0.4544231	0.4544231	0.2832626	4.565774E-02	0.1745109
Std Error	4.487161E-02		4.257872E-02	3.062575E-02	4.130043E-02

**Quartile Section of LMU\_GPA**

Parameter	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Value	2.03	2.2575	2.68	3.08	3.527
95% LCL	1.76	2.08	2.37	2.9	3.17
95% UCL	2.2	2.44	2.9	3.5	3.7

**Normality Test Section of LMU\_GPA**

Test Name	Test Decision Value	Prob Level	10% Critical Value	5% Critical Value	(5%) Can't
Shapiro-Wilk W reject normality	0.9663116	0.1469099			Can't
Anderson-Darling reject normality	0.5090508	0.1982688			Can't
Martinez-Iglewicz reject normality	0.9464365		1.090907	1.13983	Can't
Kolmogorov-Smirnov reject normality	9.709314E-02		0.112	0.122	Can't
D'Agostino Skewness reject normality	0.9760689	0.3290303	1.645	1.960	Can't
D'Agostino Kurtosis reject normality	-1.6250	0.104162	1.645	1.960	Can't
D'Agostino Omnibus reject normality	3.5933	0.165850	4.605	5.991	Can't

**Plots Section of LMU\_GPA**

**Descriptive Statistics Report**

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**Percentile Section of LMU\_GPA**

Percentile	Value	95% LCL	95% UCL	Exact Conf. Level
99	3.84			
95	3.6805			
90	3.527	3.17	3.7	95.91331
85	3.3195	3.08	3.67	97.04101
80	3.174	2.95	3.53	96.47725
75	3.08	2.9	3.5	96.42697
70	2.961	2.84	3.18	95.11157
65	2.9235	2.75	3.13	95.89295
60	2.89	2.6	3.08	95.26318
55	2.823	2.47	2.95	96.20198
50	2.68	2.37	2.9	95.60363
45	2.5155	2.35	2.85	96.31647
40	2.47	2.28	2.76	95.26318
35	2.3975	2.21	2.61	95.89295
30	2.344	2.2	2.49	95.11157
25	2.2575	2.08	2.44	96.42697
20	2.206	2.03	2.37	96.47725
15	2.0895	1.88	2.25	95.73914
10	2.03	1.76	2.2	96.43121
5	1.919			
1	1.76			

Percentile Formula: Ave  $X(p[n+1])$ **Stem-Leaf Plot Section of LMU\_GPA**

Depth	Stem	Leaves
1	1S	7
4	.	899
9	2*	00001
18	T	22222333
24	F	444445
(4)	S	6677
24	.	8889999999
14	3*	00111
9	T	23
7	F	555
4	S	667
1	.	8

Unit = .1 Example: 1 | 2 Represents 1.2

## Appendix II – LMUENGR Variables &amp; Possible Research Questions

## Variables

Variable	Key	Numeric or Attribute
MAJOR	major 1=CS 2=CE 3=EE 4=ME	A
SEX/GENDER	1=F, 2=M	A
RELIGION	religion 1=Catholic 2=other	A
ETHNIC	5 different groups, identity not known	A
DORM	1=resident 2=non-resident	A
SAT_VERB	sat verbal	N
SAT_MATH	sat math	N
SAT_TOT	sat total	N
HS_GPA	high school gpa	N
LMU_GPA	LMU gpa	N
UNIT_LMU	units completed at LMU	N

## Kinds of Analysis

	DV	IV	Possible Questions
Chi-Square Is there a relationship between (attribute) and (attribute)?	A	A	Relationship between major and gender Relationship between major and religion Relationship between major and ethnicity Relationship between major and dorming Relationship between gender and religion Relationship between gender and ethnicity Relationship between gender and dorming Relationship between religion and ethnicity Relationship between religion and dorming

<b>One-Way ANOVA</b> Is there a difference in average (DV-numeric) based on (IV-attribute)?	N	A	Difference in average SAT (verbal, math or total) Score and major Difference in average HS GPA and major Difference in average LMU GPA and major Difference in average LMU Units Completed and major
			Difference in average SAT (verbal, math or total) Score and gender Difference in average HS GPA and gender Difference in average LMU GPA and gender Difference in average LMU Units Completed and gender
			Difference in average SAT (verbal, math or total) Score and religion Difference in average HS GPA and religion Difference in average LMU GPA and religion Difference in average LMU Units Completed and religion
			Difference in average SAT (verbal, math or total) Score and ethnicity Difference in average HS GPA and ethnicity Difference in average LMU GPA and ethnicity Difference in average LMU Units Completed and major
			Difference in average SAT (verbal, math or total) Score and dorming Difference in average HS GPA and dorming Difference in average LMU GPA and dorming Difference in average LMU Units Completed and dorming

<b>Two-Way ANOVA</b> interaction of two attributes  Is there a difference in average (DV-numeric) based on (attribute) and (attribute)	N	A	Difference in average SAT (verbal, math or total) Score and major and gender Difference in average HS GPA and major and gender Difference in average LMU GPA and major and gender Difference in average LMU Units Completed and major and gender
			Difference in average SAT (verbal, math or total) Score and major and religion Difference in average HS GPA and major and religion Difference in average LMU GPA and major and religion Difference in average LMU Units Completed and major and religion
			Difference in average SAT (verbal, math or total) Score and major and ethnicity Difference in average HS GPA and major and ethnicity Difference in average LMU GPA and major and ethnicity Difference in average LMU Units Completed and major and ethnicity
			Difference in average SAT (verbal, math or total) Score and major and dorming Difference in average HS GPA and major and dorming Difference in average LMU GPA and major and dorming Difference in average LMU Units Completed and major and dorming
			Difference in average SAT (verbal, math or total) Score and gender and religion Difference in average HS GPA and gender and religion Difference in average LMU GPA and gender and religion Difference in average LMU Units Completed and gender and religion
			Difference in average SAT (verbal, math or total) Score and gender and ethnicity Difference in average HS GPA and gender and ethnicity Difference in average LMU GPA and gender and ethnicity Difference in average LMU Units Completed and gender and ethnicity
			Difference in average SAT (verbal, math or total)

		Score and gender and dorming Difference in average HS GPA and gender and dorming Difference in average LMU GPA and gender and dorming Difference in average LMU Units Completed and gender and dorming
		Difference in average SAT (verbal, math or total) Score and gender and religion Difference in average HS GPA and gender and religion Difference in average LMU GPA and gender and religion Difference in average LMU Units Completed and gender and religion
		Difference in average SAT (verbal, math or total) Score and religion and ethnicity Difference in average HS GPA and religion and ethnicity Difference in average LMU GPA and religion and ethnicity Difference in average LMU Units Completed and religion and ethnicity
		Difference in average SAT (verbal, math or total) Score and religion and dorming Difference in average HS GPA and religion and dorming Difference in average LMU GPA and religion and dorming Difference in average LMU Units Completed and religion and dorming
		Difference in average SAT (verbal, math or total) Score and ethnicity and dorming Difference in average HS GPA and ethnicity and dorming Difference in average LMU GPA and ethnicity and dorming Difference in average LMU Units Completed and ethnicity and dorming

<p><b>ANCOVA</b>  <b>Analysis of Co-Variance</b>          Is there a difference in average (DV-numeric), adjusted for (DV-numeric), based on (IV-attribute).</p> <p>Allows us to adjust for pre-existing conditions to make it more externally valid (level playing field)</p>	N	A	<p>Difference in average <math>\left\{ \begin{array}{l} SAT\ score, \\ HS\ GPA \\ LMU\ GPA \\ LMU\ units\ completed \end{array} \right\},</math></p> <p>adjusted for <math>\left\{ \begin{array}{l} SAT\ score, \\ HS\ GPA \\ LMU\ GPA \\ LMU\ units\ completed \end{array} \right\},</math></p> <p>based on <math>\left\{ \begin{array}{l} major, \\ gender, \\ religion, \\ ethnicity, \\ dorm\ residency \end{array} \right\}</math></p>
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<b>Correlation &amp; Regression</b> Is there a correlation between (DV-numeric) and (IV-numeric)?  <b>Correlation</b> gives a static number that y turns into a description positive relationship negative relationship  <b>Regression</b> tells the relationship between 2 numeric variables in terms of an algebraic magnitude of relationship? Pearson	N	N	Correlation between units completed at LMU and SAT (verbal, math, or total) Correlation between units completed at LMU and HS GPA Correlation between units completed at LMU and freshman GPA Correlation between freshman GPA and SAT (verbal, math, or total) Correlation between freshman GPA and HS GPA
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## Appendix III – Chi-Square Reports

## Research Question:

Is there a relationship between major and gender among students at LMU?

## Hypothesis:

Null: There is no relationship between major and gender among students at LMU.

Alternate: There is a relationship between major and gender among students at LMU.

## Findings:

p-value = 0.031293

alpha = 0.20

p-value < alpha; reject the null; adopt the alternate; there is a relationship between major and gender.

There are two cells with values of 5 or less, and by the assumptions of Chi-Square we can accept 1.6 cells (0.20 X 8), which rounds to approximately 2.

## Conclusions:

Fewer than expected females are ME majors

Greater than expected males are ME majors

Greater than expected males are EE majors

## NCSS reports for Chi-Square Analysis

**Cross Tabulation Report**

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Sex 1= male 2=female

**Counts Section****MAJOR**

SEX	1	2	3	4	Total
1	6	6	10	11	33
2	7	1	10	1	19
<b>Total</b>	13	7	20	12	52

The number of rows with at least one missing value is 0

**Chi-Square Contribution Section****MAJOR**

SEX	1	2	3	4	Total
1	0.61	0.55	0.57	1.50	3.23
2	1.07	0.95	0.99	2.61	5.62
<b>Total</b>	1.68	1.50	1.56	4.11	8.85

The number of rows with at least one missing value is 0

**Combined Report**

Counts, Expected, Chi-Square

<b>MAJOR</b>					
<b>SEX</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Total</b>
<b>1</b>	6	6	10	11	33
8.3	4.4	12.7	7.6	33.0	
0.61	0.55	0.57	1.50	3.23	
<b>2</b>	7	1	10	1	19
4.8	2.6	7.3	4.4	19.0	
1.07	0.95	0.99	2.61	5.62	
<b>Total</b>	13	7	20	12	52
13.0	7.0	20.0	12.0	52.0	
1.68	1.50	1.56	4.11	8.85	

The number of rows with at least one missing value is 0

#### Chi-Square Statistics Section

Chi-Square 8.854257

Degrees of Freedom 3

Probability Level 0.031293

Reject Ho

WARNING: At least one cell had an expected value less than 5.

## Appendix IV – One-Way ANOVA Reports

## Research Question:

Is there a difference in average freshman GPA and whether a student lives in a dorm?

## Hypothesis:

Null: There is no difference in average freshman GPA and whether a student lives in a dorm.

Alternate: There is a difference in average freshman GPA and whether a student lives in a dorm.

## Findings:

p-value = 0.069404

alpha = 0.20

## Conclusions:

p-value is less than alpha; reject the null; adopt the alternate; there is a difference in freshman GPA and whether a student lives in the dorm. Students who were dorms residents have a mean GPA of 2.84, as compared to 2.57 mean GPA of students who were non-residents.

## NCSS reports for one-way ANOVA

## Analysis of Variance Report

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Response LMU\_GPA

## Expected Mean Squares Section

Source	DF	Term	Denominator	Expected
Term		Fixed?	Term	Mean Square
A: DORM	1	Yes	S	S+sA
S	49	No		S

Note: Expected Mean Squares are for the balanced cell-frequency case.

## Analysis of Variance Table

Source	DF	Sum of	Mean		Prob	Power
Term		Squares	Square	F-Ratio	Level	(Alpha=0.05)
A: DORM	1	0.9642795	0.9642795	3.45	0.069404	0.444446
S	49	13.70952	0.2797862			
Total (Adjusted)	50	14.6738				
Total	51					

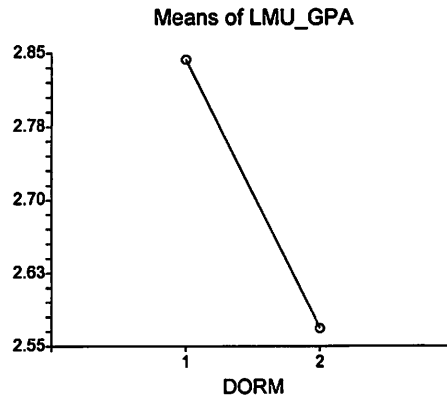
\* Term significant at alpha = 0.05

## Means and Effects Section

Term	Count	Mean	Standard	Effect
			Error	
All	51	2.708627		2.705931

**A: DORM**

1	26	2.843462	0.1037353	0.1375308
2	25	2.5684	0.1057896	-0.1375308

**Plots Section****Analysis of Variance Report**

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Response LMU\_GPA

**Fisher's LSD Multiple-Comparison Test**

Response: LMU\_GPA

Term A: DORM

Alpha=0.050 Error Term=S DF=49 MSE=0.2797862 Critical Value=2.0096

Group	Count	Mean	Different From Groups
2	25	2.5684	
1	26	2.843462	

dorm 1=resident 2=non-resident

**Notes:**

This report provides multiple comparison tests for all pairwise differences between the means. When this procedure is used only after the F-test associated with this term is significant at the same error rate, these tests are approximately accurate. When the F-test associated with this term is ignored, this procedure does not account for the multiplicity of tests. In either case, the Tukey-Kramer test is better.

## Appendix V – Two-Way ANOVA with Interaction Analysis Reports

### Research Question:

Is there a difference in average freshman GPA based on whether a student is a dorm resident and religion?

### Hypothesis:

Null:

There is no difference in average freshman GPA based on whether a student is a dorm resident.

There is no difference in average freshman GPA based on a student's major.

There is no interaction.

Alternate:

There is a difference in average freshman GPA based on whether a student is a dorm resident.

There is a difference in average freshman GPA based on a student's major.

There is an interaction.

### Findings:

For dorm residency

p-value = 0.175549

alpha = 0.20

p-value is less than alpha; reject the null; adopt the alternate; there is a difference on average freshman GPA based on student dorm residency.

For major

p-value = 0.163749

alpha = 0.20

p-value is less than alpha; reject the null; adopt the alternate; there is a difference on average freshman GPA based on a student's major.

Combined dorm and major

p-value = 0.832861

p-value is greater than alpha; not reject the null; adopt the null; there is no interaction.

### Conclusions:

Although there is a difference in average freshman GPA based on dorm residency and a student's major when analyzed independently, there is insufficient evidence that there is an interaction.

Freshman GPA for dorm residents was higher (2.84) than non-residents (2.57).

Freshman GPA for ME majors was lower (2.35) than students of other majors.

## NCSS reports for 2-way ANOVA with interaction analysis

## Analysis of Variance Report

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 Database C:\Documents and Settings\Ad ... tats\GroupProject\LMUENGR.S0  
 Response LMU\_GPA

## Expected Mean Squares Section

Source	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: DORM	1	Yes	S	S+bsA
B: MAJOR	3	Yes	S	S+asB
AB	3	Yes	S	S+sAB
S	43	No		S

Note: Expected Mean Squares are for the balanced cell-frequency case.

## Analysis of Variance Table

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: DORM	1	0.5104283	0.5104283	1.90	0.175549	0.270294
B: MAJOR	3	1.44331	0.4811035	1.79	0.163749	0.432579
AB	3	0.2335435	7.784782E-02	0.29	0.832861	0.101061
S	43	11.57047	0.2690808			
Total (Adjusted)	50	14.6738				
Total	51					

\* Term significant at alpha = 0.05

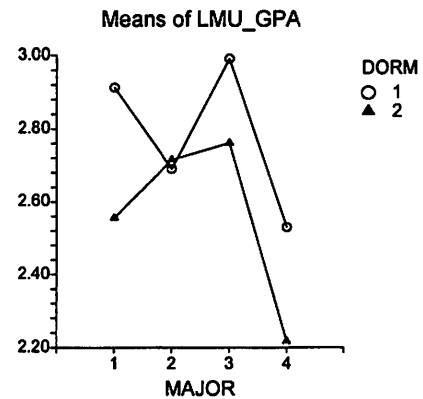
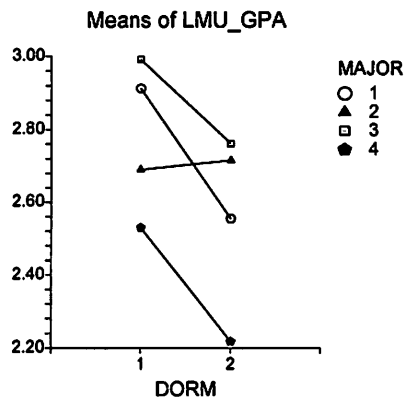
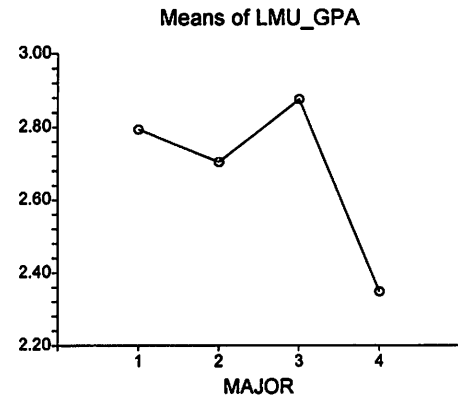
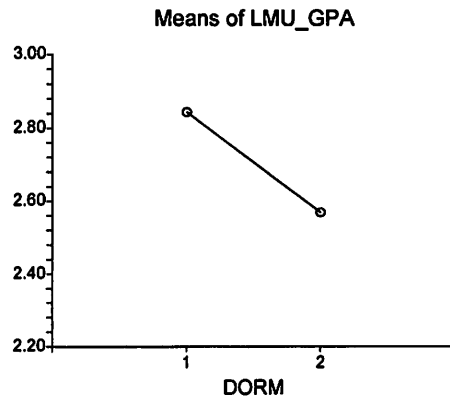
## Means and Effects Section

Term	Count	Mean	Standard Error	Effect
All	51	2.708627		2.671455
A: DORM				
1	26	2.843462	0.1017313	0.1094196
2	25	2.5684	0.103746	-0.1094196
B: MAJOR				
1	12	2.793333	0.1497444	6.229464E-02
2	7	2.704286	0.1960615	3.104464E-02
3	20	2.876	0.1159915	0.2045446
4	12	2.3475	0.1497444	-0.2978839
AB: DORM,MAJOR				
1,1	8	2.9125	0.1833987	6.933036E-02
1,2	3	2.69	0.2994889	-0.1219196
1,3	10	2.991	0.1640368	5.580357E-03
1,4	5	2.53	0.2319831	4.700893E-02
2,1	4	2.555	0.259365	-6.933036E-02
2,2	4	2.715	0.259365	0.1219196
2,3	10	2.761	0.1640368	-5.580357E-03
2,4	7	2.217143	0.1960615	-4.700893E-02

## Analysis of Variance Report

Page/Date/Time 2 12/3/2005 12:38:30 AM  
 Database C:\Documents and Settings\Ad ... tats\GroupProject\LMUENGR.S0  
 Response LMU\_GPA

## Plots Section



## Fisher's LSD Multiple-Comparison Test

Response: LMU\_GPA  
 Term A: DORM

Alpha=0.050 Error Term=S DF=43 MSE=0.2690808 Critical Value=2.0167

Group	Count	Mean	Different From Groups
2	25	2.5684	
1	26	2.843462	

## Notes:

This report provides multiple comparison tests for all pairwise differences between the means. When this procedure is used only after the F-test associated with this term is significant at the same error rate, these tests are approximately accurate. When the F-test associated with this term is ignored, this procedure does not account for the multiplicity of tests. In either case, the Tukey-Kramer test is better.

**Analysis of Variance Report**

Page/Date/Time 3 12/3/2005 12:38:30 AM  
 Database C:\Documents and Settings\Ad ... tats\GroupProject\LMUENGR.S0  
 Response LMU\_GPA

**Fisher's LSD Multiple-Comparison Test**

Response: LMU\_GPA  
 Term B: MAJOR

Alpha=0.050 Error Term=S DF=43 MSE=0.2690808 Critical Value=2.0167

Group	Count	Mean	Different From Groups
4	12	2.3475	1, 3
2	7	2.704286	
1	12	2.793333	4
3	20	2.876	4

major 1=CS 2=CE 3=EE 4=ME

**Notes:**

This report provides multiple comparison tests for all pairwise differences between the means. When this procedure is used only after the F-test associated with this term is significant at the same error rate, these tests are approximately accurate. When the F-test associated with this term is ignored, this procedure does not account for the multiplicity of tests. In either case, the Tukey-Kramer test is better.



## Appendix VI – ANCOVA Reports

## Research Question:

Is there a difference in average LMU\_ GPA, adjusted for HS GPA, based on Gender

## Hypothesis:

Null: There is no difference in average LMU\_ GPA, adjusted for HS\_ GPA based on gender

Alternate: There is a difference in average LMU\_ GPA, adjusted for HS\_ GPA based on gender

## Findings:

## For Sex:

p-value = 0.286367

alpha = 0.20

p-value is greater than alpha; not reject the null, adopt the null. There is no difference in LMU\_ GPA adjusted for HS\_ GPA based on gender

## For HS\_ GPA:

p-value = 0.039444

alpha = 0.20

## Conclusions:

p-value is smaller than alpha; reject the null; adopt the alternate. There is difference in LMU-GPA based on Gender adjusted for HS\_ GPA

## NCSS reports for ANCOVA

## Analysis of Covariance Report

Page/Date/Time 1 12/8/2005 8:52:22 PM

Database C:\Documents and Settings\AB ... rzin M\Data Bases\LMUENGR.S0

Response LMU\_ GPA

## Expected Mean Squares Section

Source	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: SEX	1	Yes	S(A)	S+sA
S(A)	49	No		S

Note: Expected Mean Squares are for the balanced cell-frequency case.

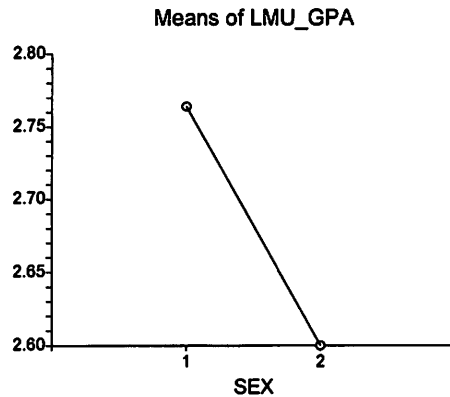
**Analysis of Variance Table**

Source		Sum of	Mean		Prob	Power
Term	DF	Squares	Square	F-Ratio	Level	(Alpha=0.20)
X(HS_GPA)	1	1.219787	1.219787	4.48	0.039444*	0.793302
A: SEX	1	0.3164894	0.3164894	1.16	0.286367	0.425143
S	49	13.34807	0.2724096			
Total (Adjusted)	51	14.72965				
Total	52					

\* Term significant at alpha = 0.20

**Means and Standard Error Section**

Term	Count	Mean	Standard Error
All	52	2.681982	
A: SEX			
1	33	2.763906	9.085613E-02
2	19	2.600058	0.1197387

**Plots Section**

## Appendix VII – Correlation Reports

Research Question: Is there a relationship between the number of units taken by the students and the resulting GPA?

Hypothesis:

Null: There is no relationship between the number of units taken and the students' GPA.

Alternate: There is a relationship between the number of units taken and the students' GPA

Findings:

p-value = 0.4422

alpha = 0.20

Conclusions: p-value is greater than the alpha; adopt the null; reject the alternate; there is no relationship between the number of units taken and the students' GPA. The distribution of GPA scores did not follow along any pattern based on the number of units taken by the students.

NCSS reports for Correlation Analysis

### Multiple Regression Report

Page/Date/Time    1    12/8/2005 9:07:30 PM  
 Database            M:\Documents\Personal\Pepper ... tation\Data Bases\LMUENGR.S0  
 Dependent          LMU\_GPA

#### Run Summary Section

Parameter	Value
Dependent Variable	LMU_GPA
Number Ind. Variables	1
Weight Variable	None
R <sup>2</sup>	0.0119
Adj R <sup>2</sup>	0.0000
Coefficient of Variation	0.1995
Mean Square Error	0.2910957
Square Root of MSE	0.5395329
Ave Abs Pct Error	17.413

Parameter	Value
Rows Processed	52
Rows Filtered Out	0
Rows with X's Missing	0
Rows with Weight Missing	0
Rows with Y Missing	0
Rows Used in Estimation	52
Sum of Weights	52.000
Completion Status	Normal Completion

#### Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Minimum	Maximum
UNIT_LMU	52	71.57692	11.94817	42	89

LMU_GPA	52	2.704038	0.5374167	1.76	3.84
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**Regression Equation Section**

Independent Variable	Regression Coefficient b(i)	Standard Error Sb(i)	T-Value to test H0:B(i)=0	Prob Level	Reject H0 at 5%?	Power of Test at 5%
Intercept	3.0548	0.4587	6.659	0.0000	Yes	1.0000
UNIT_LMU	-0.0049	0.0063	-0.775	0.4420	No	0.1184

**Estimated Model**

$$3.05482202664582 - 4.90079134486365E-03 * \text{UNIT\_LMU}$$
**Regression Coefficient Section**

Independent Variable	Regression Coefficient	Standard Error	Lower 95% C.L.	Upper 95% C.L.	Standardized Coefficient
Intercept	3.0548	0.4587	2.1334	3.9762	0.0000
UNIT_LMU	-0.0049	0.0063	-0.0176	0.0078	-0.1090

Note: The T-Value used to calculate these confidence limits was 2.009.

**Analysis of Variance Section**

Source	DF	R2	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1		380.2148	380.2148			
Model	1	0.0119	0.1748659	0.1748659	0.601	0.4420	0.1184
Error	50	0.9881	14.55479	0.2910957			
Total(Adjusted)	51	1.0000	14.72965	0.2888167			